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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/524,280

02/08/2005

Scott Corboy

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EXAMINER

JELSMA, JONATHAN G

ART UNIT

PAPER NUMBER

1795

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/524,280	<b>Applicant(s)</b> CORBOY ET AL.	
	<b>Examiner</b> Jonathan Jelsma	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02/08/2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 February 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>04/19/2005, 02/08/2005</u> .                                  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Summary***

1. This is the initial office action based on application 10/524,280 filed on 02//08/2005 by Scott Corboy, Ronald Roes, and Hennie De Weerd.
2. Claims 1-30 are currently pending and have been fully considered.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 3, 10, and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
5. Claims 3, 10, and 21 recites the limitation "threshold" in lines 2-3 of claim 3, line 3 of claim 10, and line 3 of claim 21. There is insufficient antecedent basis for this limitation in the claim. The claim relates to a first or second "threshold" respectively. However, no "threshold" has been previously defined.

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 1-2, 4-12, 14-23, and 25-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over SPORON-FIEDLER (US 5,208,124) in view of KOTANI (US 6,221,539 B1).

9. With respect to claims 1, 15, and 26-27. SPORON-FIEDLER teaches a method to compensate for the difference in line widths between isolated and dense patterns, with multiple geometries (column 4 lines 22-28). Dense patterns will form narrower line widths than isolated patterns, and compensation for the mask pattern is done on the mask pattern itself to result in isolated line widths on the wafer to be equal to the line widths of lines in the dense pattern (column 4 lines 38-45). The amount that the features are altered in order to compensate for the optical proximity effect is dependent upon the line width of the feature, as well as the pitch (column 5 lines 31-33). Areas which are considered to be isolated are made narrower than the opaque portions which are considered to be part of the dense pattern due to the proximity effect (column 6 lines 1-5). So the features on the mask are not merely altered based on their pitch, but also based on the feature size which results from proximity effects (column 7 lines 39-56).

10. SPORON-FIEDLER does not explicitly teach determining the dimensions of a second feature, and sizing the second aperture depending on the dimensions of the second features.

11. KOTANI teaches a method of correcting a pattern by shifting amounts of the edge positions of a pattern in order to optimize the pattern (column 3 lines 28-32). The transferred image of the pattern is first calculated on the wafer (column 5 lines 35-37). The edges are then altered by either a delta x or a delta y (column 5 lines 41-44). The amount changed delta x and or delta y is different for each pattern (column 5 lines 60-67). This difference is exemplified by the correction coefficient  $M_i$  (column 5 lines 61-63).

12. At the time of the invention one having ordinary skill in the art would have been motivated to combine the method of designing a reticle of SPORON-FIEDLER which includes different sizing values based on the pitch and size of the pattern being corrected, with the method of KOTANI which teaches using a different design rule determined for each individual pattern, in order to more accurately create an accurate representation of the design pattern (KOTANI column 6 lines 18-19).

13. Further, while neither SPORON-FIEDLER nor KOTANI explicitly teaches two types of features on the same mask, SPORON-FIEDLER does teach that its method is applicable to all reticle geometries (column 4 lines 27-28), and KOTANI further includes both line and space patterns (column 5 lines 28-29) as well as contact hole patterns (column 6 lines 55-56). Therefore at the time of the invention one having ordinary skill in the art would have been motivated to use the design features of SPORON-FIEDLER

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and KOTANI in a mask pattern with both line and space patterns, as well as contact hole patterns as taught by KOTANI, in order to accurately reproduce the design pattern with multiple geometries.

14. With respect to claims 2 and 16. SPORON-FIEDLER further teaches, that the same effect as described in other examples can be achieved by widening the opaque dense region as that of narrowing the opaque isolated portion (column 5 lines 46-50). SPORON-FIEDLER then further teaches that negative photoresist if used, would have the opposite consequences, that of the isolated lines being formed narrower than the dense pattern lines, required adjustment of the method (column 5 lines 51-59), such as the need to increase the width of the isolated line, making the isolated region larger.

15. With respect to claims 4-5, 8, 11, 19, and 22. KOTANI teaches altering a dimension in the y direction so that it is increased by an offset value in order to more accurately reproduced the design pattern, and wherein the offset causes that dimension to be larger (column 5 lines 33-57), the y direction is taken to being the length of the feature. The dimension y, being offset is orthogonal to a second dimension such as x. Further the second dimension x may also be adjusted by a correction value (column 5 lines 40-44).

16. With respect to claims 6 and 17. SPORON-FIEDLER does not explicitly teach the shapes being a plurality of holes, however, does teach that their method may include all reticle geometries which may include holes (column 4 lines 26-28). Further KOTANI does explicitly teach the method of compensating for optical proximity effect in

a contact hole pattern comprising a plurality of contact holes (column 6 lines 51-56, see Fig. 9).

17. With respect to claims 7 and 18. SPORON-FIEDLER does teach its method for dense or isolated line patterns (column 4 lines 23-25). Further KOTANI as well teaches its method for a line and space pattern (column 5 lines 25-29). Both of which may be considered a plurality of slits.

18. With respect to claims 9 and 20. Neither SPORON-FIEDLER nor KOTANI explicitly teaches that the second type aperture corresponding to the second type feature with the smaller first dimension, are increased in a second dimension more than those with a larger first dimension. However, KOTANI does teach an iterative method of changing the mask pattern by a correction coefficient in order to obtain a final corrected pattern in order to create a pattern which is substantially equivalent to the design pattern (column 5 lines 33-67, to column 6 lines 1-36). The amount the correction being used in order to create the correction pattern is iteratively determined based on the specific pattern being calculated. Therefore, one having ordinary skill in the art would have been motivated to use the iterative method of KOTANI to create a corrected pattern, where the relative increase of the dimensions may be varied in order to more accurately generate the design pattern.

19. With respect to claims 10 and 21. Neither SPORON-FIEDLER nor KOTANI explicitly teaches that the larger of the second type apertures are sized a third way and the smaller second apertures is sized a fourth way. However, KOTANI does teach an iterative method of changing the mask pattern by a correction coefficient in order to

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obtain a final corrected pattern in order to create a pattern which is substantially equivalent to the design pattern (column 5 lines 33-67, to column 6 lines 1-36). The amount the correction being used in order to create the correction pattern is iteratively determined based on the specific pattern being calculated. Therefore, one having ordinary skill in the art would have been motivated to use the iterative method of KOTANI to create a corrected pattern, where the relative increase of the dimensions may be varied, such as in a third and fourth way, in order to more accurately generate the design pattern. Further KOTANI does not explicitly teach comparing a first dimension to a second threshold, however, it inherently does so. For example KOTANI inherently compares the value of the first dimension with that of 0, where 0 is considered to be analogous to the second threshold value. In this case if the second dimension is 0, or alternatively, there is no pattern, then the pattern alteration methods will not be used, but if the value is greater than 0, then the pattern alternation method of KOTANI may then be used.

20. With respect to claims 12, 14, 23, 25 and 28-29. SPORON-FIEDLER further teaches that its method may be used for integrated circuit design, and of forming features such as conductive lines (column 2 lines 7-12). Further KOTANI teaches its method for making a gate layer and a wiring layer of a DRAM (column 3 lines 15-16), as well as contact holes (column 1 lines 44-45). The method of KOTANI teaches the method of irradiating light through the mask to expose the mask features onto a resist on a wafer, then developing the resist and etching the resist pattern into the wafer to form the features on the wafer, the transferring the features from the mask onto at least



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a portion of the wafer in a single step (column 1 lines 18-25). Therefore, at the time of the invention one having ordinary skill in the art would recognize that the method of SPORON-FIEDLER and KOTANI may be used to form a variety of different integrated circuit patterns, including memory cells and interconnect layers.

21. Claims 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over SPORON-FIEDLER (US 5,208,124) in view of KOTANI (US 6,221,539 B1) and MARTIN (US 2003/0003385 A1).

22. With respect to claim 3. Claim 3 is dependent upon claim 1 which is rejected above under 35 U.S.C. 103(a) in view of SPORON-FIEDLER and KOTANI. SPORON-FIEDLER further teaches that the dense portions represented by 72, 74, and 76 may be widened, or that the isolated portion may be narrowed to achieve the optical proximity correction (column 5 lines 47-50). However, neither SPORON-FIEDLER nor KOTANI explicitly teaches determining the relative isolation of the patterns against a threshold.

23. MARTIN teaches that the printed linewidth of a pattern may vary with different pitches between dense and isolated conditions (paragraph 0021). MARTIN then determines that a dense line corresponds to a line:spacing ratio for 1:1, and an isolated line to line:space ratio of at least 1:4 (paragraph 0023).

24. At the time of the invention one having ordinary skill in the art would have been motivated alter the patterns based on either isolated or dense features as taught by SPORON-FIEDLER in view of KOTANI, using the threshold for determining dense

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versus isolated features as taught by MARTIN in order to more accurately compensate for the dense-isolated offset (see MARTIN paragraph 0022).

25. Claims 13 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over SPORON-FIEDLER (US 5,208,124) in view of KOTANI (US 6,221,539 B1) and KUJI (US 2001/0024758 A1).

26. Claim 13 is dependent upon claim 1, and claim 24 is dependent upon claim 15, both of which are rejected above under 35 U.S.C. 103(a) in view of SPARON-FIEDLER and KOTANI. However, neither SPORON-FIEDLER nor KOTANI explicitly teaches using a halftone phase shift mask. However, KUJI teaches that halftone phase shift masks are used to help improve mask pattern definition (paragraph 0007).

27. Therefore, at the time of the invention one having ordinary skill in the art would have been motivated to use a halftone phase shift mask as taught by KUJI in the pattern correction method of SPORON-FIEDLER in view of KOTANI in order to help improve mask pattern definition.

### ***Conclusion***

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Jelsma whose telephone number is (571)270-5127. The examiner can normally be reached on Monday to Thursday 7:00 a.m. - 5:00 p.m.

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29. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

30. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark F. Huff/

Supervisory Patent Examiner, Art Unit 1795

JGJ